

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 6,878,245 B2  
APPLICATION NO. : 10/085338  
DATED : April 12, 2005  
INVENTOR(S) : Srinivas Gandikota et al.

Page 1 of 7

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

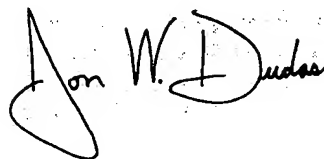
The title page should be deleted and substitute therefore the attached title page.

Drawings:

Delete drawings sheets 2-6, and substitute therefore the drawing sheets, consisting of Figs. 2-6 as shown on the attached pages.

Signed and Sealed this

Tenth Day of October, 2006

A handwritten signature in black ink, reading "Jon W. Dudas". The signature is stylized, with a large, looped initial "J" and a distinct "D" at the end.

JON W. DUDAS  
*Director of the United States Patent and Trademark Office*



US006878245B2

(12) **United States Patent**  
Gandikota et al.

(10) Patent No.: **US 6,878,245 B2**  
(45) Date of Patent: **Apr. 12, 2005**

(54) **METHOD AND APPARATUS FOR  
REDUCING ORGANIC DEPLETION DURING  
NON-PROCESSING TIME PERIODS**

(75) Inventors: **Srinivas Gandikota**, Santa Clara, CA (US); **Chris R. McGuirk**, San Jose, CA (US); **Deenesh Padhi**, San Jose, CA (US); **Sivakami Ramanathan**, Fremont, CA (US); **Muhammad Atif Malik**, Santa Clara, CA (US); **Girish A. Dixit**, San Jose, CA (US)

(73) Assignee: **Applied Materials, Inc.**, Santa Clara, CA (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/085,338**

(22) Filed: **Feb. 27, 2002**

(65) **Prior Publication Data**

US 2003/0159936 A1 Aug. 28, 2003

(51) Int. Cl.<sup>7</sup> ..... **C25D 17/00; C25D 21/00**

(52) U.S. Cl. .... **204/275.1; 204/224 R; 204/237; 205/101; 205/148**

(58) Field of Search ..... **204/237, 238, 204/245, 263, 264, 275.1, 276; 205/99, 101, 123, 148**

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,051,001 A	9/1977	Inoue et al.	204/151
4,132,605 A	1/1979	Tench et al.	204/1 T
4,290,856 A	9/1981	Inoue	204/4

(Continued)

**OTHER PUBLICATIONS**

F. A. Lowenheim, *Electroplating*, McGraw-Hill Book Company, New York, 1978, pp. 152-155.\*

*Primary Examiner*—Roy King

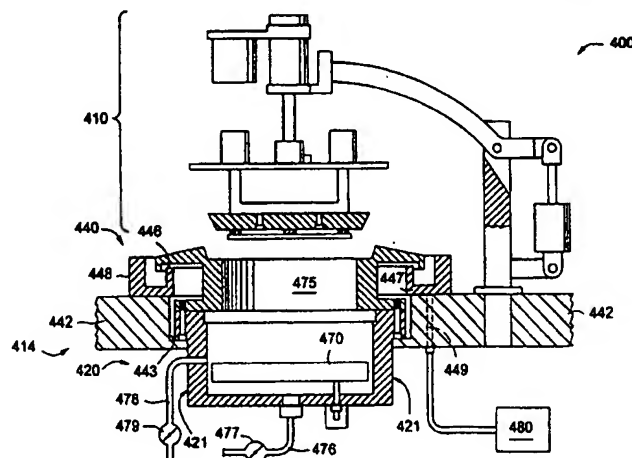
*Assistant Examiner*—William T. Leader

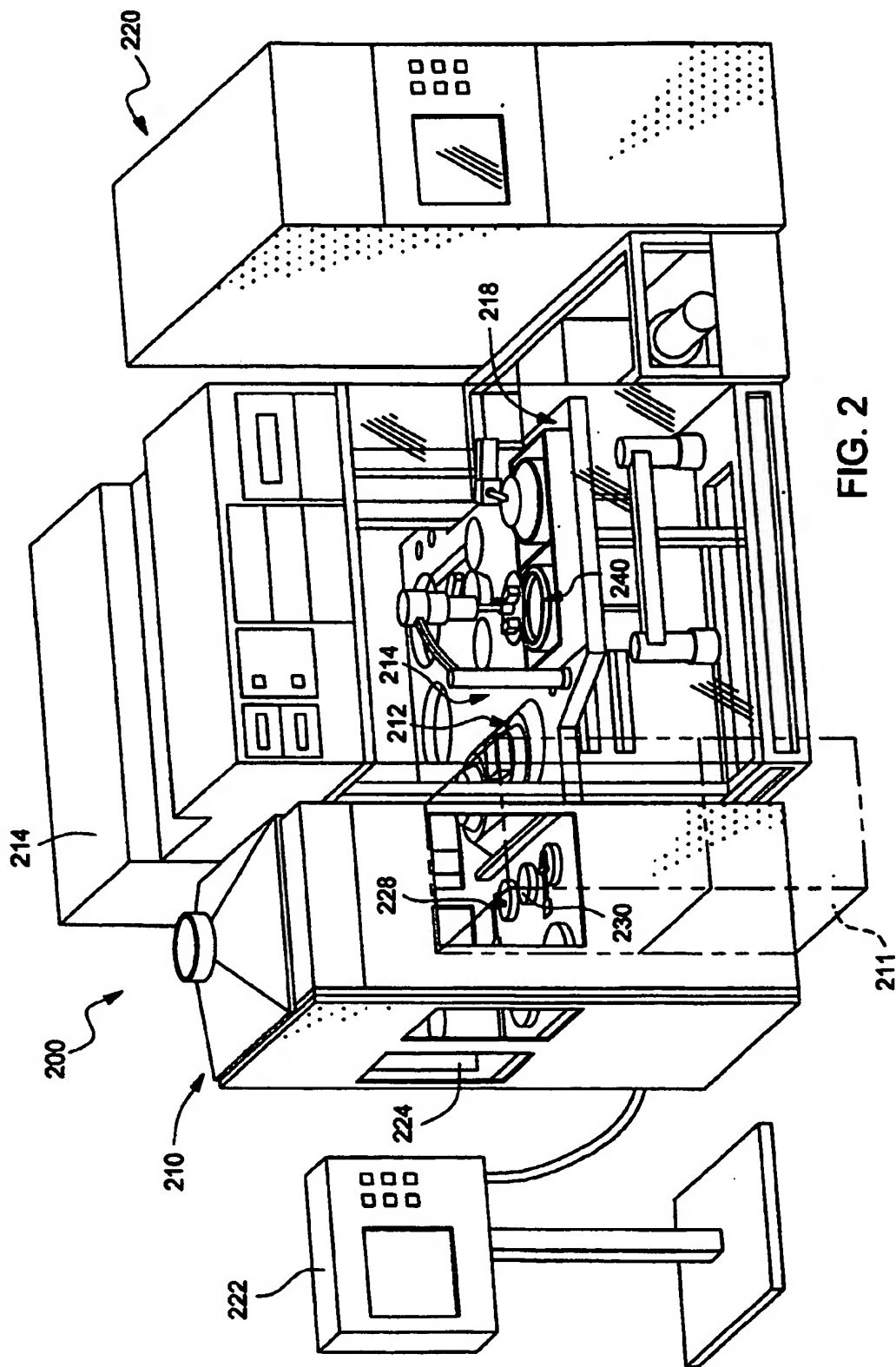
(74) *Attorney, Agent, or Firm*—Moser, Patterson & Sheridan

(57) **ABSTRACT**

Embodiments of the invention generally provide an apparatus and method for replenishing organic molecules in an electroplating bath. The replenishment process of the present invention may occur on a real-time basis, and therefore, the concentration of organics minimally varies from desired concentration levels. The replenishment method generally includes conducting pre-processing depletion measurements in order to determine organic depletion rates per current density applied in the electroplating system. Once the organic depletion rates per current density are determined, these depletion rates may be applied to an electroplating processing recipe to calculate the volume of organic depletion per recipe step. The calculated volume of organic depletion per recipe step may then be used to determine the volume of organic molecule replenishment per unit of time that is required per recipe step in order to maintain a desired concentration of organics in the plating solution. The calculated replenishment volume may then be added to the processing recipe so that the replenishment process may occur at real-time during processing periods. The apparatus generally includes a selectively actuated valve in communication with a fluid delivery line, wherein the valve is configured to fluidly isolate a plating cell during a non-processing time period. The valve may be controlled by a system controller, and thus, the fluid level in the cell may be controlled during a non-processing time period.

**17 Claims, 7 Drawing Sheets**





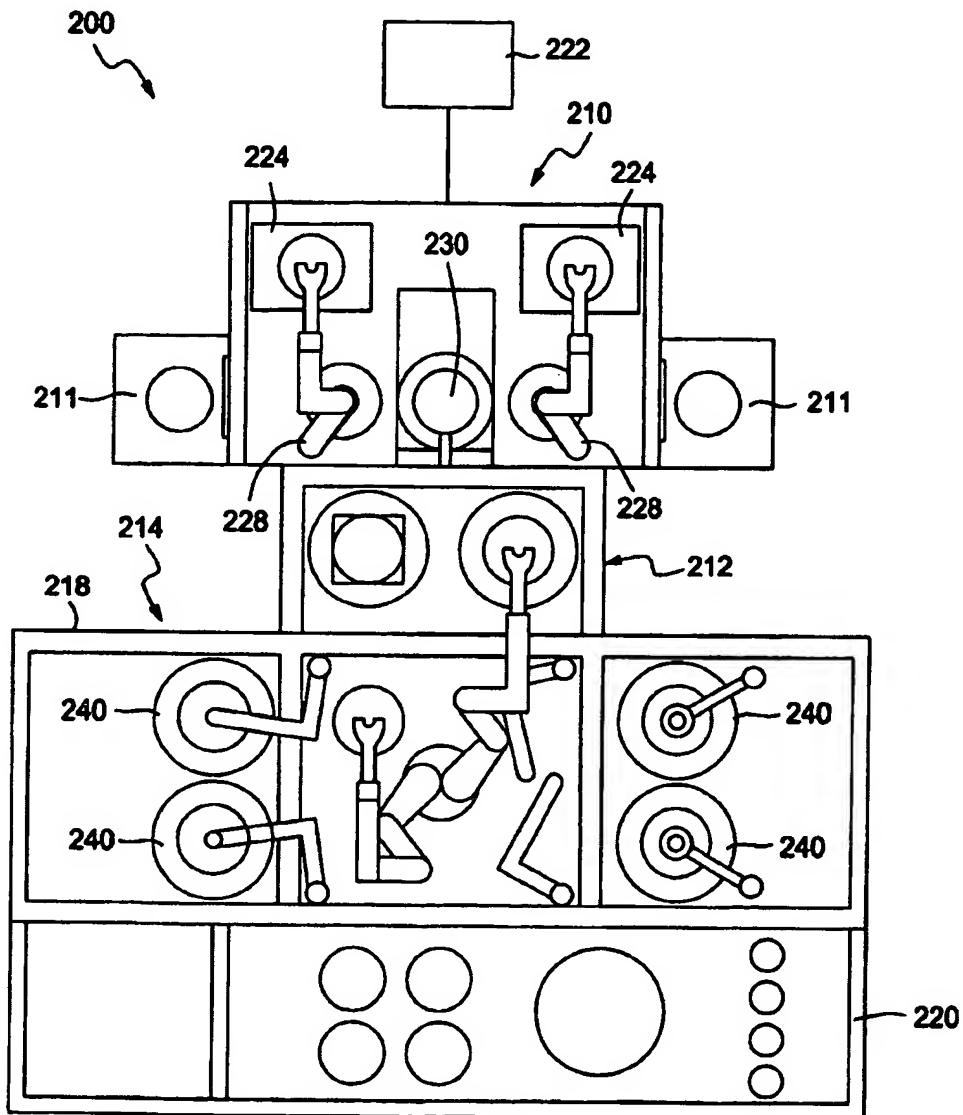
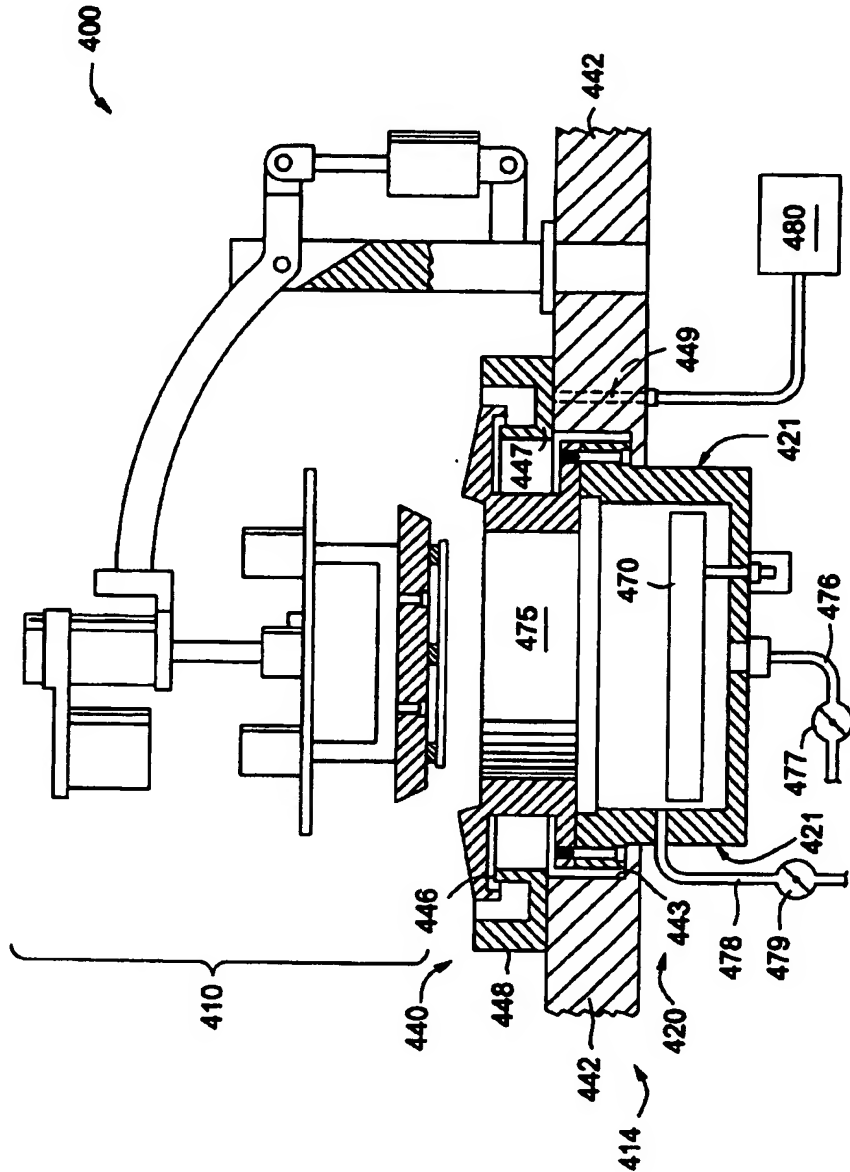


FIG. 3



**FIG. 4**

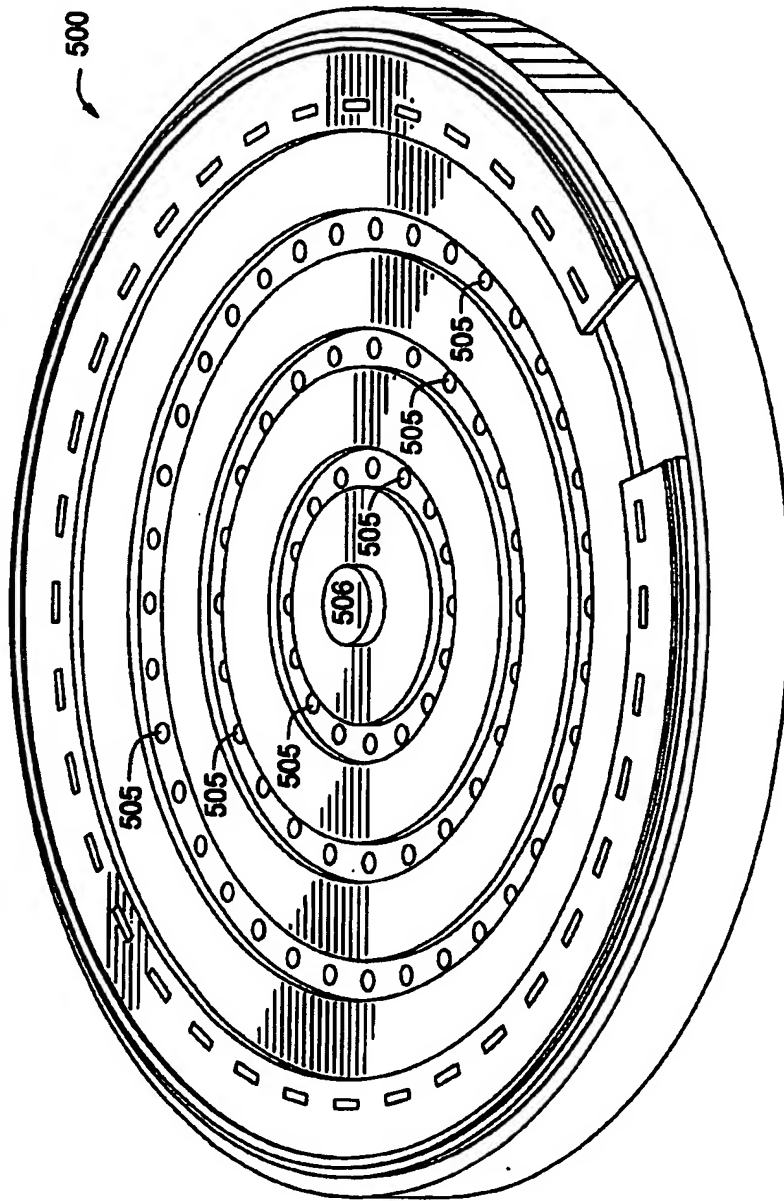


FIG. 5

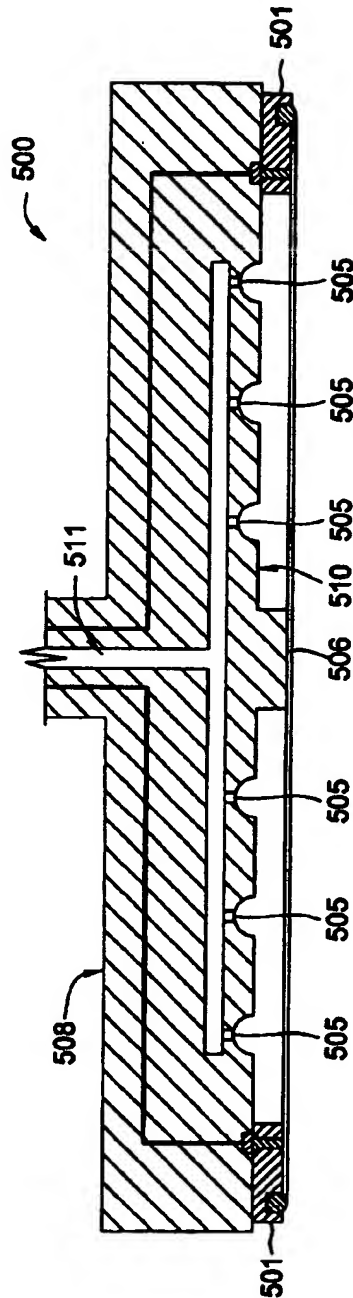


FIG. 6